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METHOD FOR THE LOCATION-DEPENDENT RETRIEVAL OF INFORMATION FROM DATABASES AND SYSTEM FOR CARRYING OUT SAID METHOD	
(57) Abstract	
<p>Information is requested from a user terminal, especially from a mobile user terminal which cooperates with a communication system with substantially stationary transmitting stations, in order to retrieve information from a database by using a search engine in which information with location-related attributes is stored. The request is transmitted by the user terminal to a computer managing the database along with data characterizing the location of the user terminal. Said location data is produced or retrieved by the user terminal by way of data that is transmitted to the user terminal once the user terminal contacts at least one transmitting station of the communication system. The data used as location data or used to produce location data is either retrieved from memories or is detected by measurements and relates to geographical locations of transmitting stations, to the coverage area of transmitting stations, to signal transmit times, signal intensities, signal reflections, directional angles etc. The computer uses said location data for controlling the search engine in such a manner that it selects from the database only information having respective location-related attributes or organizes the data according to said attributes. The selected information and/or information organized according to location-related attributes is transmitted to the user terminal. The inventive method facilitates an information retrieval process that is automatically target-oriented and that is especially useful for tourism, transport and communications, the economy etc.</p>	

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**METHOD FOR THE LOCATION-DEPENDENT RETRIEVAL OF INFORMATION FROM  
DATABASES AND SYSTEM FOR CARRYING OUT SAID METHOD**

- 5 The invention relates to a method pursuant to the generic term of the independent patent claim. The method serves for retrieving information from at least one database. Furthermore, the invention relates to a system for carrying out said process pursuant to the generic term of the corresponding, independent patent claim.
- 10 Examples of sources of current information include radio, television, teletext, newspapers, geographic maps and roadmaps as well as lists of all kinds from which the recipient of the information searches for and selects the current information by hand, so to speak, with the help of indices wherever necessary. Information can be retrieved in a significantly target-oriented manner with the help of search engines from databases that
- 15 can be accessed using electronic means, thus for instance, from CDs, or even from the internet and intranet. However, in doing so, the abundance of information and the formulation of the criteria according to which a search machine is supposed to work results in new problems that in many cases discourage or even overstrain the recipient of information.

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The task underlying the invention is to create a method in which the retrieval of information from databases can be controlled automatically. Furthermore, the invention is

faced with the task of creating a system for carrying out said method.

This task is solved by the method and the system as defined in the patent claims.

- 5 In the method pursuant to the invention, information is requested from a location, especially from a variable location and the search engine used is controlled by way of criteria relating to this location. In other words, the search engine is restricted to information that is associated with the location of the information request. In doing so it is possible for the user, though this is not required, to control the search machine further.
- 10 The system pursuant to the invention has user terminals for requesting and receiving the information, particularly mobile user terminals, means for storing and updating at least one database and for searching the requested information in the database as well as a communication network for transmitting the information request and the requested information between the database and the user terminal. In doing so, at least the mobile
- 15 user terminals are equipped for the determination of their respective location and at least one database for searching according to location-related criteria.

The method pursuant to the invention thus is based on a combination of a data- or news communication network with at least one database that is managed by a computer using a

20 search engine. The communication system has a communication network and a multitude of user terminals, especially user terminals that cooperate with the communication network. The communication network can also have stationary user terminals. The

installations of the communication network, particularly its transmitting stations (base stations), are substantially stationary. For the purpose of a controlled search process in the database, a mobile user terminal determines its current location in the communication network and transmits this to the program with which information is being searched in the database. Stationary user terminals advantageously retrieve the appropriate location-related information from a memory.

The database contains information that is characterized by location-related attributes of such kind, that it can be selected and/or organized (sorted) with the help of the search engine and in a location-dependent manner.

The user terminals are equipped for requesting information from the database and for receiving the information, i.e. in addition to means for transmitting and receiving information, they also have means for entering the request and means to display the requested information, for instance keyboard and monitor, as is known from the 'Communicator' interface of the company Nokia.

Information is requested from the user terminal by the communication network together with location data related to the user terminal to the computer managing the database. Due to this the computer is initiated to select and/or organize information by way of location-data and to transmit the selected and/or organized information to the user terminal.

A mobile user terminal transmits its current location, by contacting at least one accessible transmitting station of the network in order to receive information about its location or identity. While this contact is being established, even attributes of the data transmission are recorded and also used for the determination of location. The data transmitted while

the contact is being established that characterizes the location of the user terminal are transmitted, for instance, via a service channel to the computer of a database selected by the user. For instance, in cases in which establishing contact with transmitting stations is not possible or location-related attributes are delivered that are too inaccurate, it is  
5 advantageous to equip the user terminal in such a manner that the user can enter location-related attributes or specify them more precisely by way of entering the data.

The specifications about the data that are required for the determination of location and if necessary, also the specifications about the characteristics of transmitting stations of the  
10 communication network can be stored, for instance, in the transmitting stations and can be transmitted to a user terminal every time contact is established.

On the other hand, during contact establishment, only the identity of transmitting stations can be transmitted, wherein then the user terminal retrieves the data required for the  
15 determination of location from a corresponding memory on the basis of the transmitted identity. For this purpose, for instance, a native memory can be provided in which the locations and, if necessary, additional characteristics of transmitting stations are stored permanently for the entire communication network. The same data can also be stored on a card that is replaceably positioned in the user terminal and which can be accessed by a  
20 provider for the data updating. An updating process of such type can be carried out, for instance, during down times. Since a memory of such type has to be very large for a long-range network and accurate specifications and also has to be updated repeatedly, it is more advantageous to store and update the corresponding data in a memory that is accessible via the communication network and to continuously make available such data  
25 to the user terminal depending on its current location, for instance, via a service channel.

The simplest method for determination of location is to assign the user terminal to the transmitting station of the communication network lying next to its location and to define its location as being inside the coverage area of this transmitting station. In a present day mobile telephone network, coverage areas of such type have a diameter of approx. 100 m. to 10 km. This, depending on the requested information, is already sufficient for a corresponding selection or organization of information. In this case, the location of the user terminal corresponds to the coverage area of the transmitting station and can be taken directly from the data of the communication network. For the purpose of improving the accuracy, the coverage areas can be determined experimentally so that they already contain corrections for signal reflections etc.

If the user terminal can contact two or more than two stationary transmitting stations, the location of the user terminal can be determined using the same method more accurately than the location within the overlapping range of the coverage areas of the transmitting stations. Data characterizing an overlapping range of such type can either be made available from the communication network (like the coverage areas of the individual transmitting stations) or can be determined in the user terminal with the help of a corresponding algorithm from the data for the coverage areas of the transmitting stations with which the user terminal can establish contact.

More accurate data about the location of the user terminal can be determined if not only the coverage areas of transmitting stations are analyzed but also the duration of the signal transmission (signal duration) between the user terminal and the transmitting station is recorded and incorporated in the determination of the location. By including a distance measurement of such type in the determination of location via the signal duration, the location is recorded as essentially on one circular curve or circular arc around the

transmitting station. In case of contact with two transmitting stations, the location is recorded as intersection points of two circular curves or circular arcs.

5 If the user terminal can establish contact with three or more than three transmitting stations of a present day mobile telephone network, it is possible to accurately determine the location of a mobile terminal to approximately 30 m. by recording the signal duration and with the help of a suitable calculation algorithm.

10 As in case of all triangulatory determinations, the accuracy of the determination of location increases if more transmitting stations can be included in the determination of location. It is also seen that the attainable accuracy increases if for the determination of location, stations with larger and with smaller distances from the location to be determined (most different distances possible) are combined if these stations are arranged in the most different possible directions from the location to be determined. Thus it is  
15 advantageous to equip the algorithm used for determining the location in such a manner that in all cases, in which the user terminal can contact a majority of transmitting stations, the algorithm has the most different directions and distances possible from the location to be determined in order to select transmitting stations for determining the location.

20 In the same way as the signal duration between user terminal and transmitting station, even the transmission intensity that likewise characterizes the distance between the user terminal and transmitting station and/or the directional angle can be recorded and used further in the algorithm for determination of location.



Furthermore, the accuracy of the determination of location depends on the accuracy of the data that characterize the location of the transmitting stations. It is advantageous to not only restrict these data to geographic coordinates, but to also include in it transmission characteristics, such as reflections.

5

It is also known to determine in the receiving part of the mobile telephone, whether a connection with a transmitting station is direct or whether it is based on a reflected connection (echo) with a longer duration and to use the result of the determination for improving reception. Information of such type can also be used to improve the determination of location by requesting it from the receiving part of the user terminal and processing it in a corresponding algorithm together with other data. Depending on the antenna constellation, the process of location determination can be carried out with accuracy up to 20 to 30 m.

15 Particularly for cases in which the data made available from the communication network for the determination of location (locations and coverage areas of transmitting stations) do not enable any precise location determination, it is advantageous to expand the algorithm of location determination together with the corresponding time using a memory for already determined locations and to upgrade the algorithm so as to include in the location determination locations that are previously determined for a moving user terminal and the thus determined movement vectors, at least for examining the plausibility of a newly determined location.

25 The inclusion of determined movement vectors for a moving user terminal enables the target-oriented control of the search engine. By adjusting the functioning of the search

machine to the direction and the speed of the moving user terminal, it is possible to restrict the search to information that refers to localities lying geographically in front of the user terminal. By comparing movement vectors with geographic information (for instance, course of expressways or railway lines) it is possible to restrict the search also  
5 to appropriately interesting information (for motorists or train drivers).

For a more specific adjustment of the search function, it is also advantageous to store, in addition, experience values related to search criteria created by the user, especially data from previous information requests etc.

10

An algorithm for the determination of location by way of retrieved and recorded data is advantageously installed in the user terminal. This algorithm creates data that characterize the location, can be transmitted, for instance via a service channel to the computer managing the database and can be used by the search machine directly as  
15 search criteria.

The communication system is, for instance, a UMTS-mobile communications network (Universal Mobile Telecommunications System) or a GSM (Global System for Mobile Communications) wireless network with corresponding mobile user terminals. In the  
20 publication WO-93/12590, a process is described which is used to determine the position of a mobile radio terminal inside a network cell from the signal propagation time and the complex weights. The publication DE-19524927 deals with a process for directing a subscriber toward a destination within a UMTS network, that also works with the

location of a subscriber. Both the said publications can thus provide methods for location determination for a mobile terminal in a communications network. This location determination can be used as a component of the method pursuant to the invention.

- 5 It is also known to evaluate echo effects and thus to correct from signal propagation times, distances for reflections which makes it possible to improve location determinations that are based on recorded signal propagation times.

- 10 The communication between a user (via user terminal) and the computer managing the database and/or the search engine can be automated, i.e. it can be designed such that the user is automatically provided with information corresponding to his location.

- 15 The communication between the user (via the user terminal) and the computer managing the database and/or search engine can also be interactive, i.e. it can be designed such that the user actively requests information from a specific database and if necessary can enter criteria that the search engine is supposed to use in addition to the location attributes. If necessary, the user can also store information in the database that is then automatically supplemented with a location attribute that corresponds to the current location of the corresponding user terminal.

- 20 Naturally it is also possible to search using a search engine the database provided for the method pursuant to the invention in which information is provided with location attributes by actively entering selected attributes of such type. In doing so, it is important to enter the attributes accurately. This can sometimes lead to difficulties. These  
25 difficulties do not result in case of the method pursuant to the invention, i.e. by using location data that are automatically determined in the communications system.

The databases and search engines that are used in the method pursuant to the invention do not differ per se from known databases and search engines and are therefore not described here in more detail.

- 5 The information stored in the database and provided with location attributes can be of the most diverse nature, for instance extracts from geographic maps, registers of hotels, parking lots, movie theaters, theaters, shops, time table of trains, trams etc.

- The method pursuant to the invention can play a central role in case of the individual traffic- and information logistics during important occasions. If a visitor of an important  
10 occasion of any such type carries along an appropriately equipped mobile user terminal, even during travel he can request information about conveniently located, not yet occupied parking spaces or 'events' depending on his individual travel route (track or street). Thus it is possible for every person to make use of information and accordingly  
15 plan his travel, i.e. already overfull parking lots, traffic jams or inconveniently located events can be avoided in a planned fashion slightly earlier.

For this purpose it may be advantageous to filter the information requested by a user not only according to the location but also as per the current time.

20

The method pursuant to the invention can be used, for instance, for purposes of leisure, tourism or business. It creates a new market for information providers wherever the

corresponding communication networks are available. Naturally, in doing so, it is also possible to request information out of the databases provided for the method pursuant to the invention from stationary user terminals (for instance from internet-capable computers) whose location can be found out, for instance, from the telephone number  
5 used.

The mobile user terminal used by the recipient of information has, like a cell phone for instance, a keypad and a display with whose help the recipient of information selects the desired information by controlling the menu and, if necessary, can define the location  
10 criteria in more detail (for instance, by selecting a range volume) and/or specifies additional search criteria. The transmitted information is visualized on the display. However it is also possible to equip the user terminal for requesting information by means of a keystroke or for requesting information in purely acoustic ways and to transmit the requested information in acoustic form to the user.

15 It is also advantageous to combine the method pursuant to the invention with additional services in such a manner that additional operations are activated by way of the selection made of the transmitted information. Thus for instance, it is possible to directly order or purchase tickets for selected means of transport and traffic routes, reserve or purchase  
20 entrance tickets for selected events, or reserve hotel rooms in selected hotels.

Another example for the application of the method pursuant to the invention is a recipient of information who wishes to look at train departure timings from the railway station located nearest and wishes to reserve a travel ticket for one of the departing trains. In  
25 doing so it is advantageous if the recipient of information can define additional search criteria (arrival/departure, destination), for access to the database of the railway system,

that contains, for instance, the entire travel time table, apart from the automatically supplied criterion of his location, and if the transmitted information is also filtered or can be filtered according to the current time. The definite train is selected and the travel ticket is ordered in the usual manner and these processes are therefore not a component of the method pursuant to the invention.

An additional example is the case of viewing an event calendar of a geographic region wherein the information filtered from a database is organized in such a manner that the events are listed (organized) in the sequence of growing distances between the event locations and the current location of the user terminals. Even in this case, a time filter proves to be advantageous that at the point of the information request, automatically filters out events that are already concluded or already started.

## PATENT CLAIMS

1. Method for retrieving information from at least one database managed by a computer using a search engine, wherein information is requested from a user terminal, which cooperates with substantially stationary transmitting stations of a communication network, wherein the request for information is transmitted to the computer and wherein the computer selects and/or organizes information from the database and transmits it to the user terminal, **characterized in that** the information in the database is provided with location-related attributes, that the request for information is transmitted to the computer together with the location-related attributes characterizing the location of the user terminal and that the location-related data and location-related attributes are correlated for selecting and/or organizing the information.
2. Method pursuant to claim 1, **characterized in that** the user terminal is mobile and that the user terminal generates or retrieves the location-related data and transmits it to the computer.
3. Method pursuant to claim 2, **characterized in that** the user terminal contacts at least one transmitting station for generating or retrieving location-related data. During this contact, data characterizing the identity of the transmitting station are transmitted to the user terminal and the user terminal retrieves data characterizing the location of the transmitting station from a memory on the basis of the transmitted identity data.

4. Method pursuant to claim 3, **characterized in that** the memory for the data characterizing the location of transmitting stations is provided in the user terminal or can be accessed by the user terminal via the communication network.
- 5
5. Method pursuant to claim 3, **characterized in that** the data characterizing the location of transmitting stations are transmitted automatically to the user terminal depending on the location of the user terminal and is stored in the memory of the user terminal.
- 10
6. Method pursuant to claim 2, **characterized in that** the user terminal contacts at least one transmitting station for generating or retrieving location data and that during this contact, the data characterizing the location of the transmitting stations are transmitted to the user terminal.
- 15
7. Method pursuant to claim 6, **characterized in that** the data characterizing the location of transmitting stations are transmitted on a service channel to the user terminal.
- 20
8. Method pursuant to one of the claims 3 to 7, **characterized in that** the data characterizing the location of transmitting stations relate to the geographic position and the covering area of the transmitting station.
- 25
9. Method pursuant to one of the claims 3 to 8, **characterized in that** during contact between the user terminal and the transmitting station, data related to the



transmission characteristics are recorded and that these data are used for generating location data in addition to the data characterizing the location of the transmitting stations.

- 5      10. Method pursuant to claim 9, **characterized in that** the recorded data relate to the signal transmission times, the signal intensity, reflections or the directional angle.
- 10      11. Method pursuant to one of the claims 3 to 10, **characterized in that**, from a majority of transmitting stations that are contacted for determining the location of user terminals, only those transmitting stations with the most diverse possible distances and directions to the user terminal are selected for generating the location data.
- 15      12. Method pursuant to one of the claims 1 to 11, **characterized in that**, further search criteria are used for controlling the search engine in addition to the determined location data.
- 20      13. Method pursuant to claim 12, **characterized in that** the additional search criteria are geographical characteristics of the determined location and/or the time.
14. Method pursuant to one of the claims 2 to 13 **characterized in that** the determined location-data are stored together with the time of their determination and that they are used as movement vectors for further determination of location.

15. Method pursuant to one of the claims 1 to 14, **characterized in that** further search criteria are entered at the user terminal for controlling the search engine in addition to the retrieved or generated location data.
- 5
16. System for retrieval of information that has a communication network with several substantially stationary transmitting stations, several user terminals cooperating with the communication network for requesting and receiving information and at least one database with memory for storing the information, a
- 10 computer with a search engine for managing the database and for transmitting information in a controlled manner to user terminals, **characterized in that** the system has additional means for generating and retrieving location data that relate to the location of user terminals, and means for transmitting location data to the computer of the database and that the computer and the database are provided for
- 15 selecting and/or organizing the information according to location data.
17. System pursuant to claim 16, **characterized in that** at least one part of the user terminals is mobile and that the means for generating or retrieving location data are provided in the user terminals.
- 20
18. System pursuant to claim 17, **characterized in that** the user interfaces for generating or retrieving location data have means for contacting transmitting stations and means for receiving data from the contacted transmitting stations.

19. System pursuant to claim 18, **characterized in that** the user interfaces for generating and retrieving location data have means for retrieving data from external memory.
- 5
20. System pursuant to claim 19, **characterized in that** the communication network has a service channel for transmitting data between transmitting stations and user terminals and between user terminals and external memory.
- 10
21. System pursuant to one of the claims 16 to 20, **characterized in that** methods are provided for recording data relating to the characteristics of the transmission between the user terminal and a transmitting station and that methods for generating location data using this recorded data are also provided.
- 15
22. System pursuant to claim 21, **characterized in that** the means for recording transmission characteristics are provided for recording signal transmission times, signal intensities, reflections and/or directional angles.
- 20
23. System pursuant to one of the claims 16 to 22, **characterized in that** the communication network is a UMTS communications network or a GSM wireless network.

[see source for bilingual International Search Report]